

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**



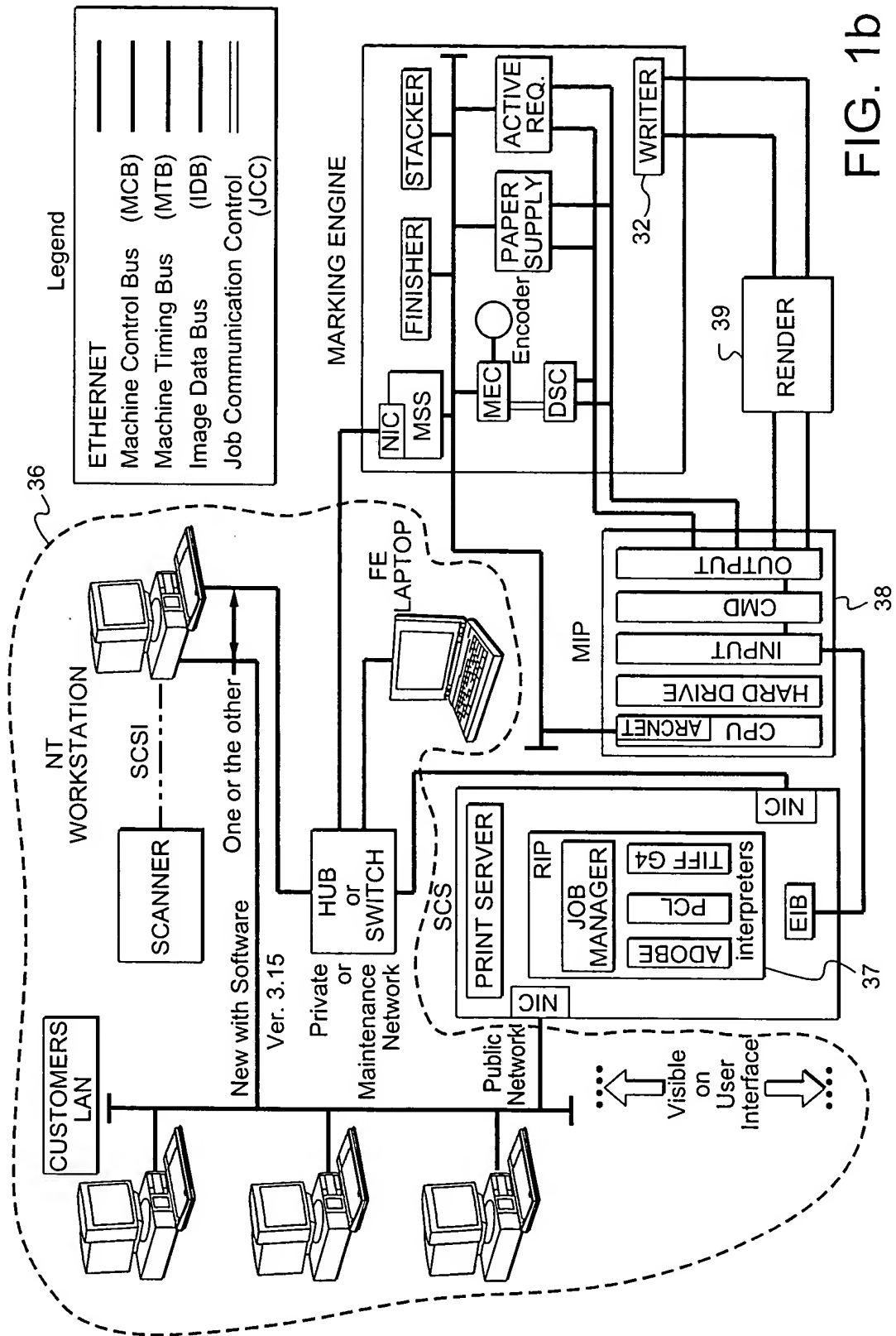


FIG. 1b

# Algorithm Block Diagram

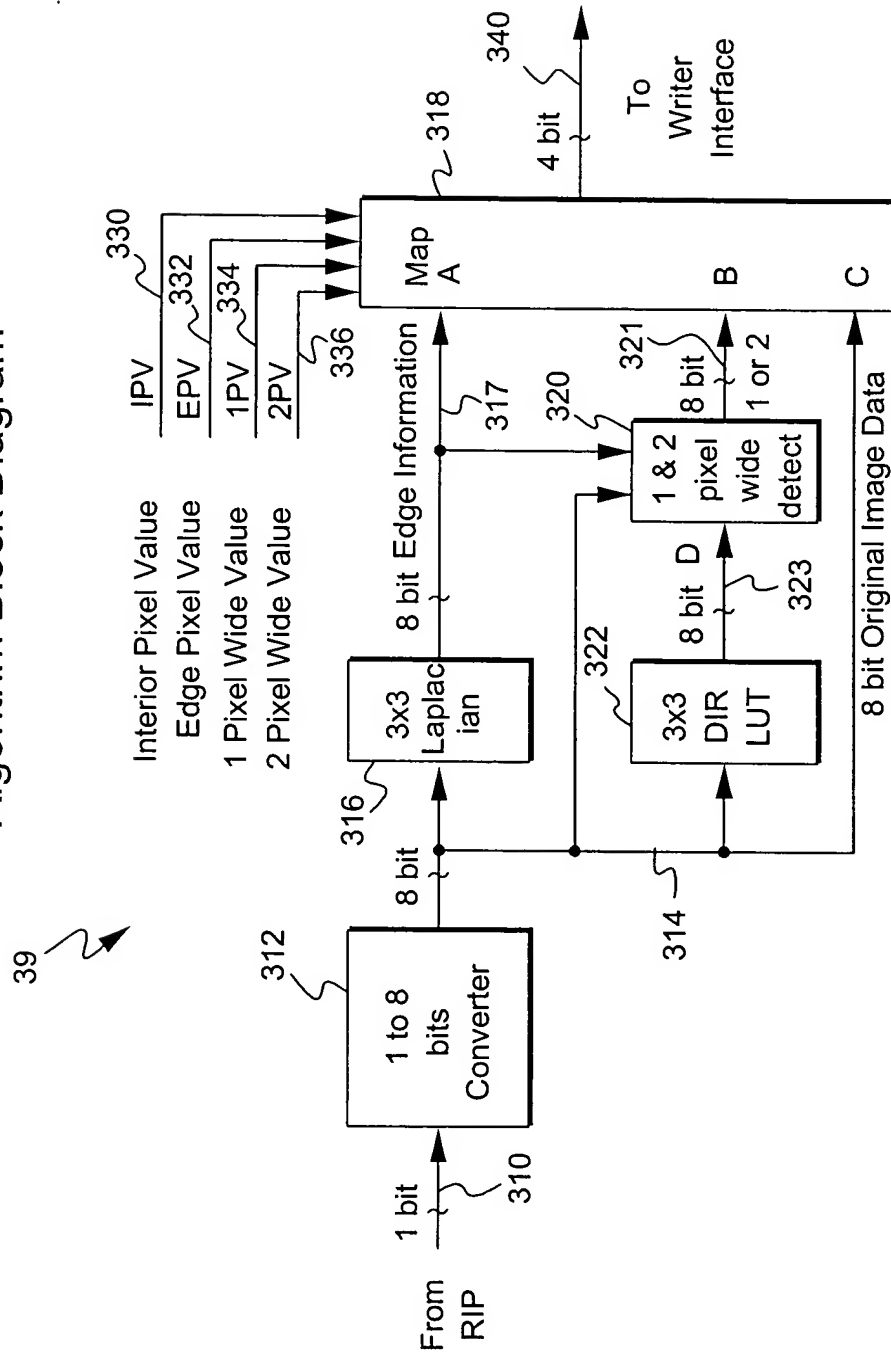


FIG. 2

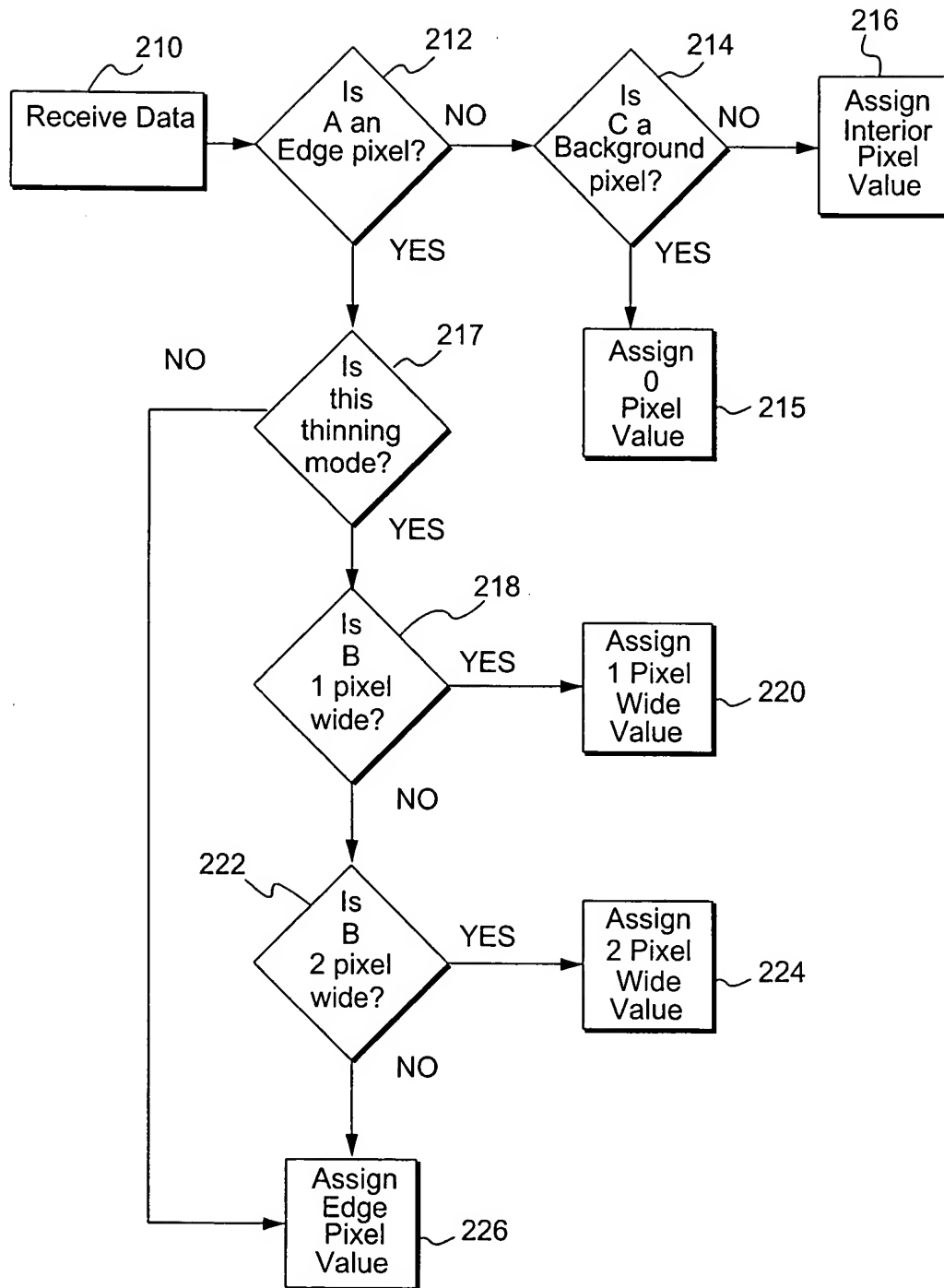
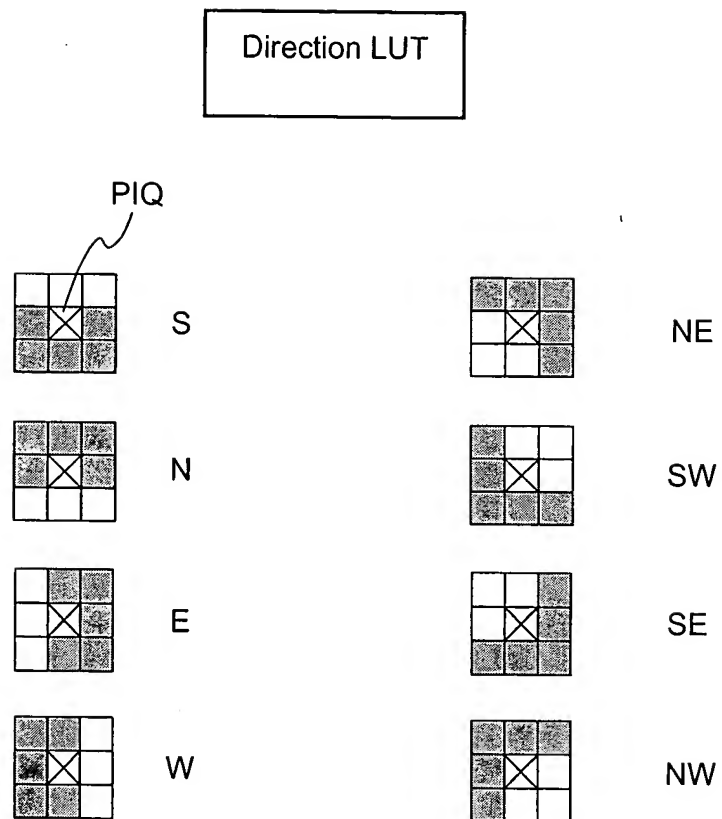
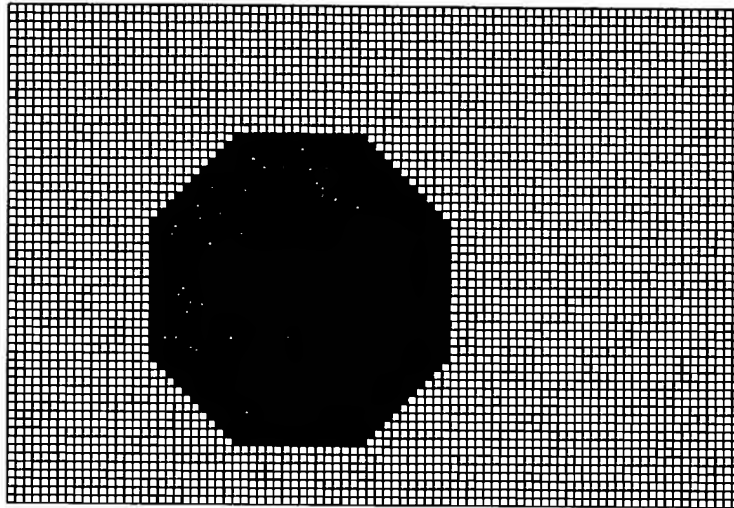


FIG. 3



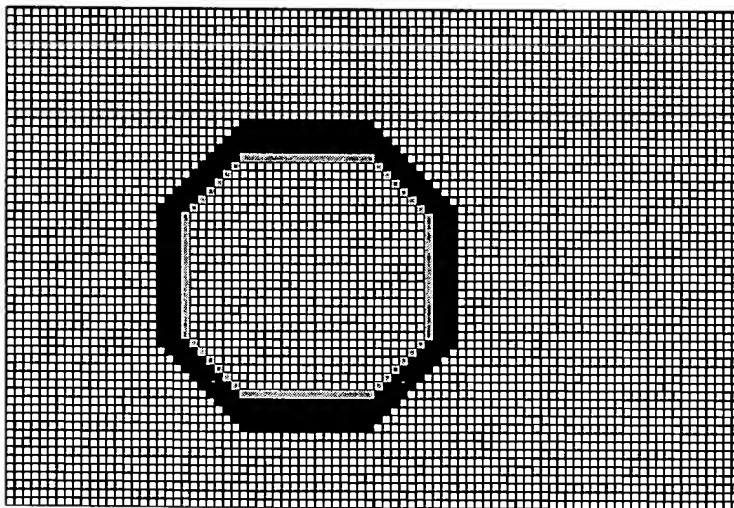
All other combinations result in zero.

FIG. 4



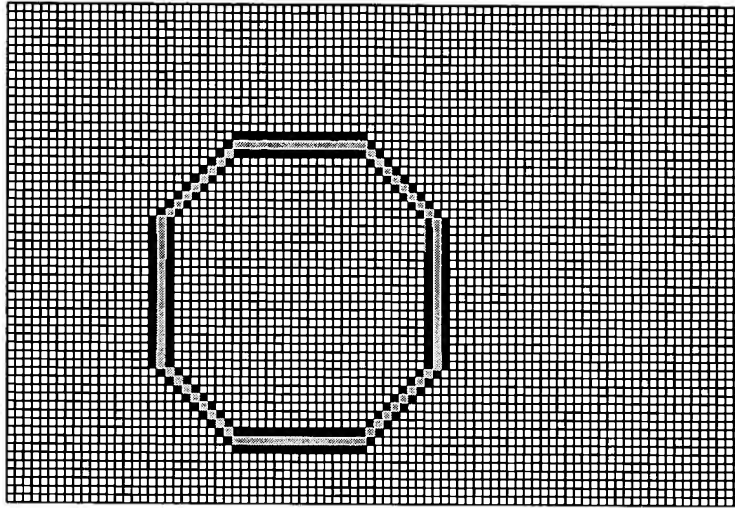
Original object  
bitmap

FIG. 5a



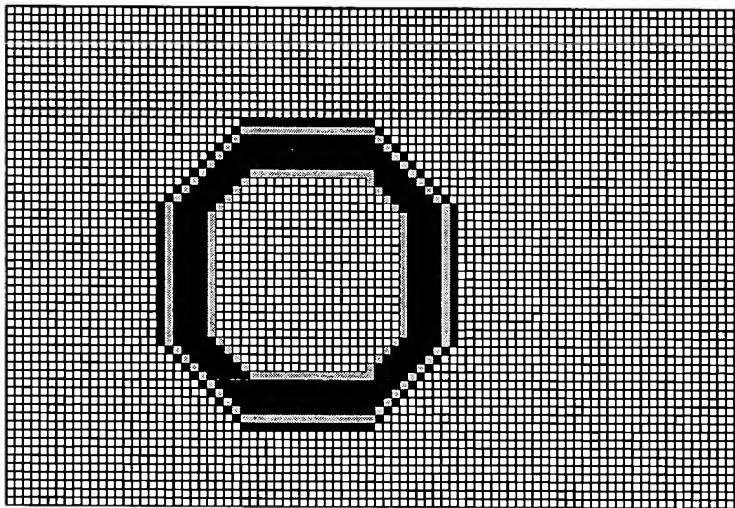
Four onion skin  
layers when thinning

FIG. 5b



Three onion  
skin layers when  
thickening

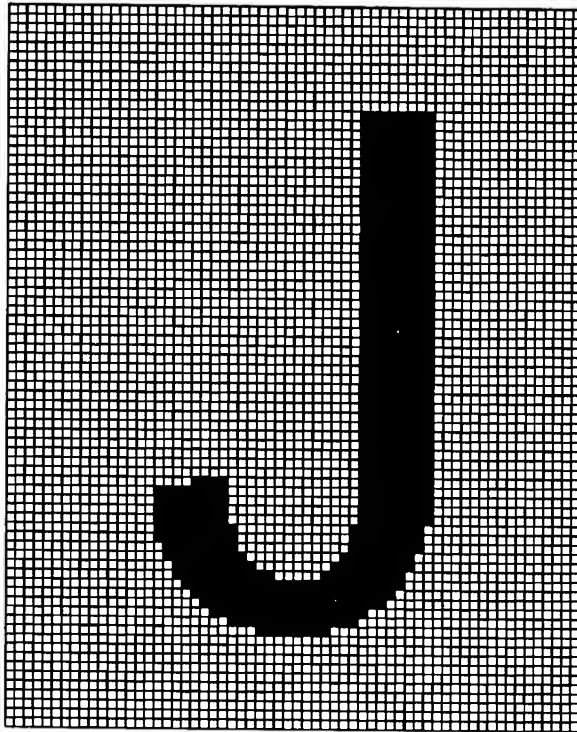
FIG. 5c



All layers  
(thickening and  
thinning)

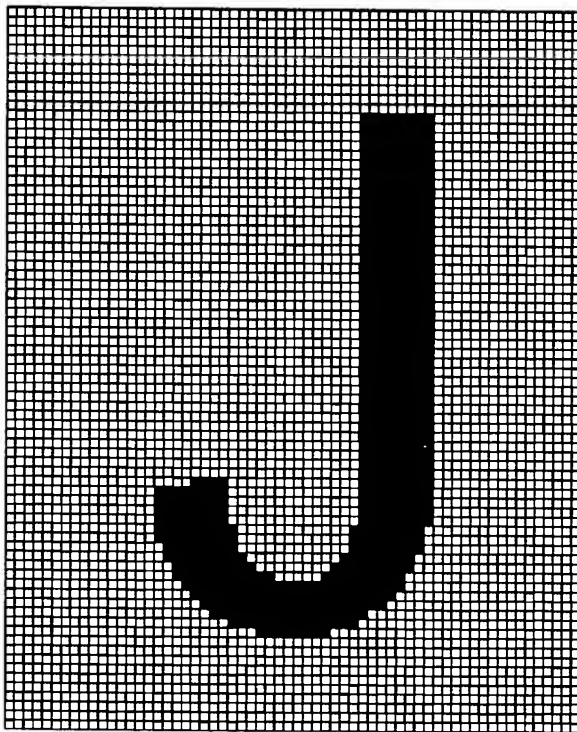
FIG. 5d





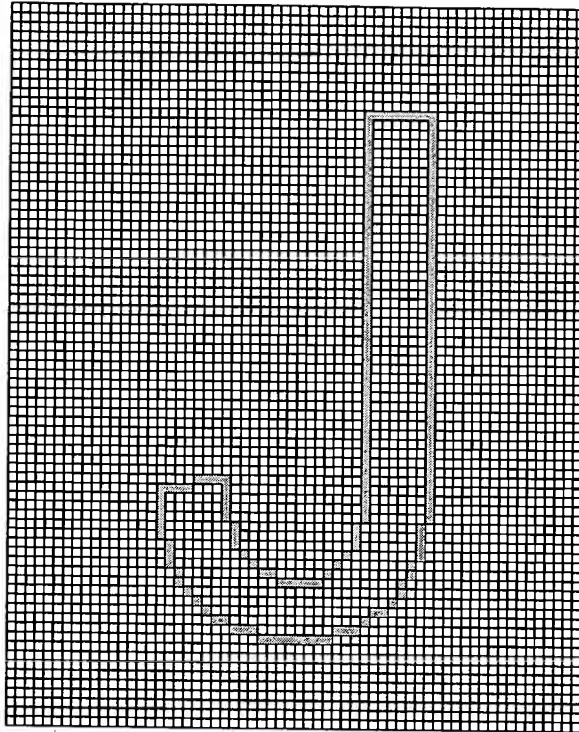
Original  
Binary Bitmap

FIG. 6a



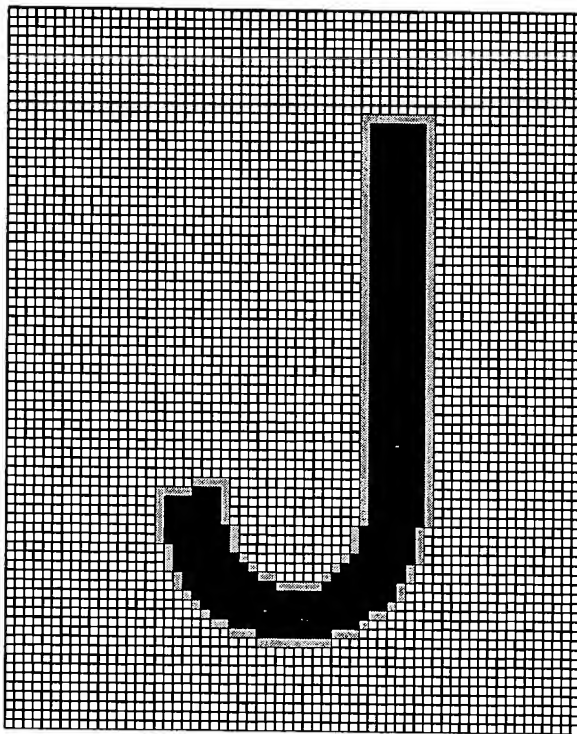
Same grey level pixel value  
value assigned to edges  
and solid area density

FIG. 6b



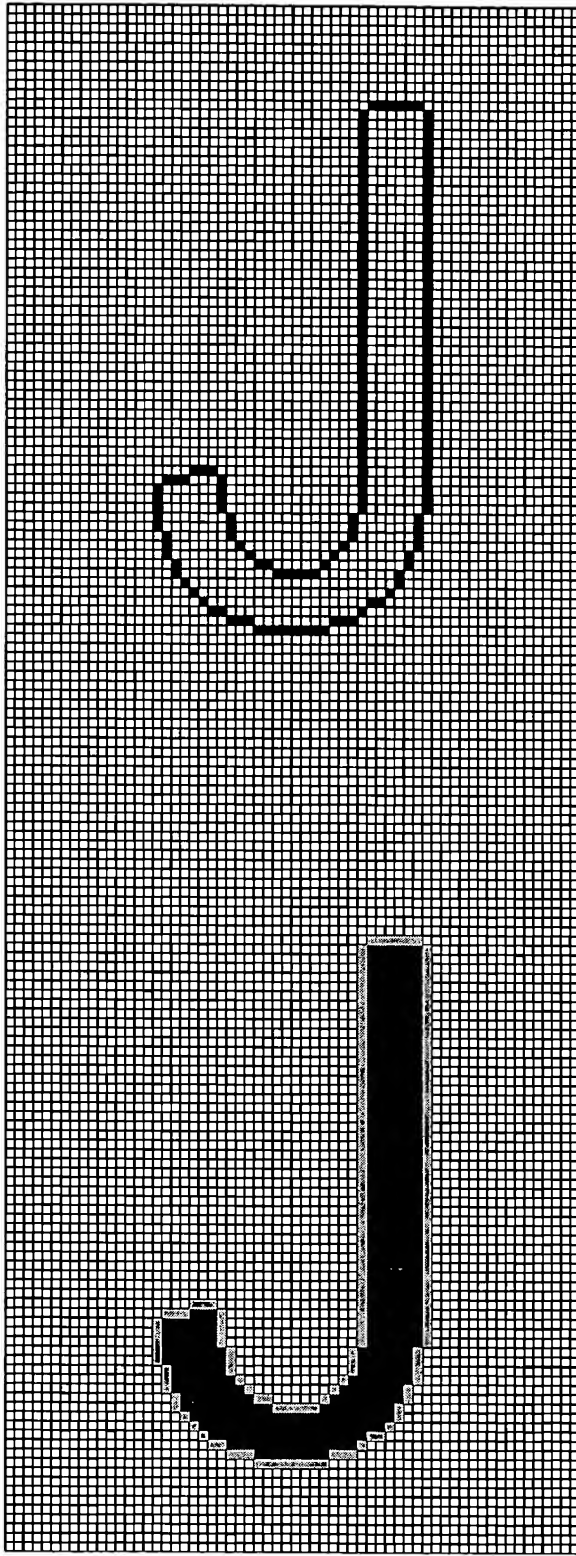
Edges  
when thinning

FIG. 6c



Lightened-  
Solid area density reduced  
Letter thinner

FIG. 6d



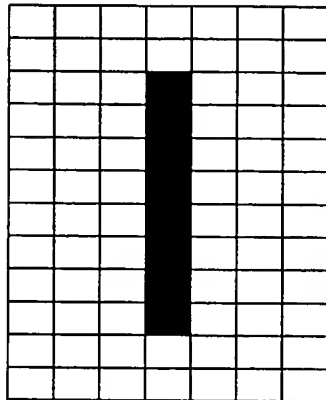
Edges  
when thickening

FIG. 6e

Thickened  
Letter thickened by applying  
gray to edges which were  
originally white

FIG. 6f

## 1 Pixel Wide Detection



Original 1 pixel wide line

FIG. 7a

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	255	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Edge Pixels

FIG. 7b

0	0	0	0	0	0	0
0	0	SE	S	SW	0	0
0	0	E	S	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	0	W	0	0
0	0	E	N	W	0	0
0	0	NE	N	NW	0	0
0	0	0	0	0	0	0

Direction Values

FIG. 7c

BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	EP	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	1W	BP	BP	BP
BP	BP	BP	EP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP

Assignment

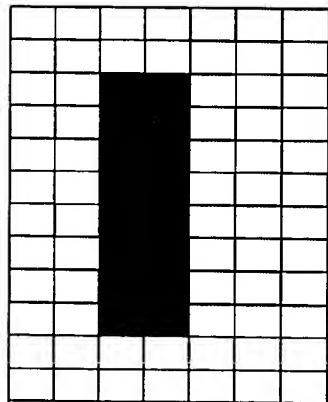
BP: Background Pixel

EP: Edge Pixel

1W: One Pixel Wide Line

FIG. 7d

## 2 Pixel Wide Detection



Original 2 pixel wide line

FIG. 8a

0	0	0	0	0	0	0
0	0	0	0	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	255	255	0	0	0
0	0	0	0	0	0	0
0	0	0	0	0	0	0

Edge Pixels

FIG. 8b

0	0	0	0	0	0	0
0	SE	S	S	SW	0	0
0	E	SE	SW	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	E	W	W	0	0
0	E	NE	NW	W	0	0
0	NE	N	N	NW	0	0
0	0	0	0	0	0	0

Direction Values

FIG. 8c

BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	EP	EP	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	2W	2W	BP	BP	BP
BP	BP	EP	EP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP
BP	BP	BP	BP	BP	BP	BP

Assignment

BP: Background Pixel

EP: Edge Pixel

2W: Two Pixel Wide Line

FIG. 8d

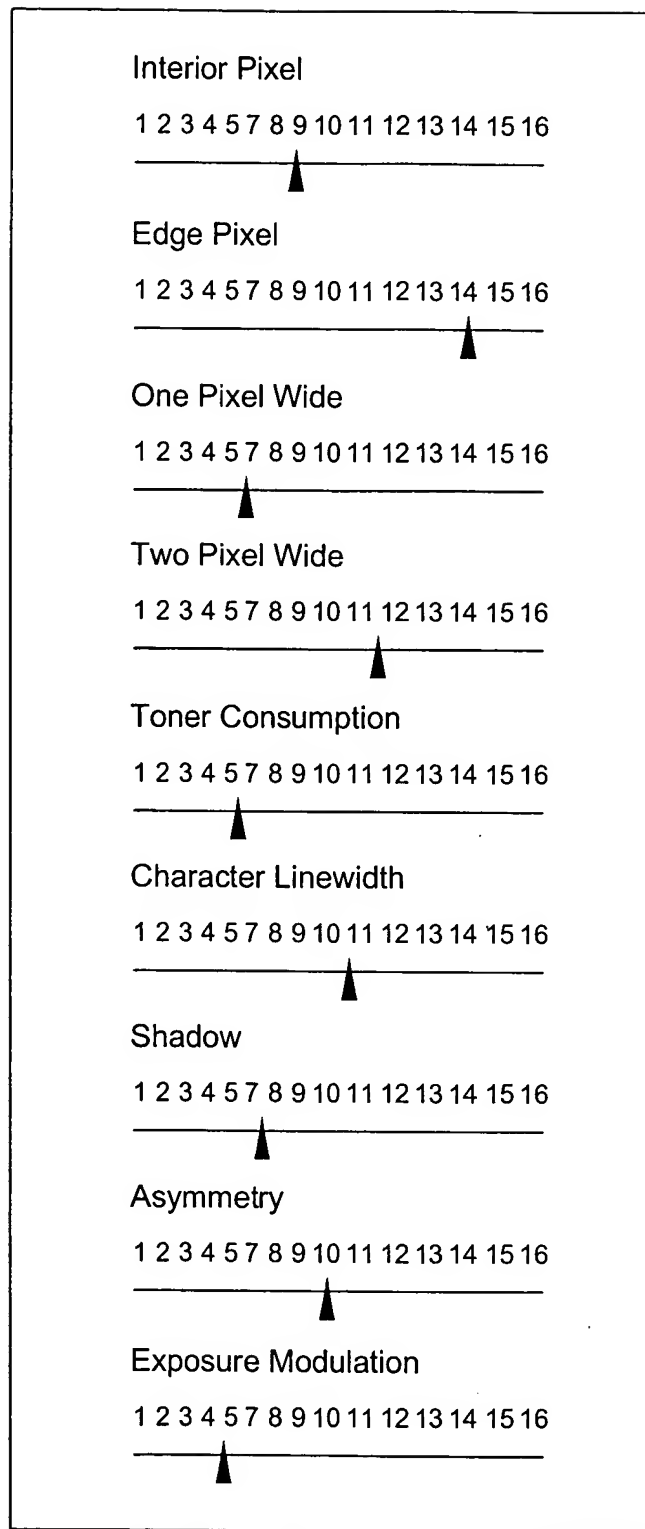


FIG. 9

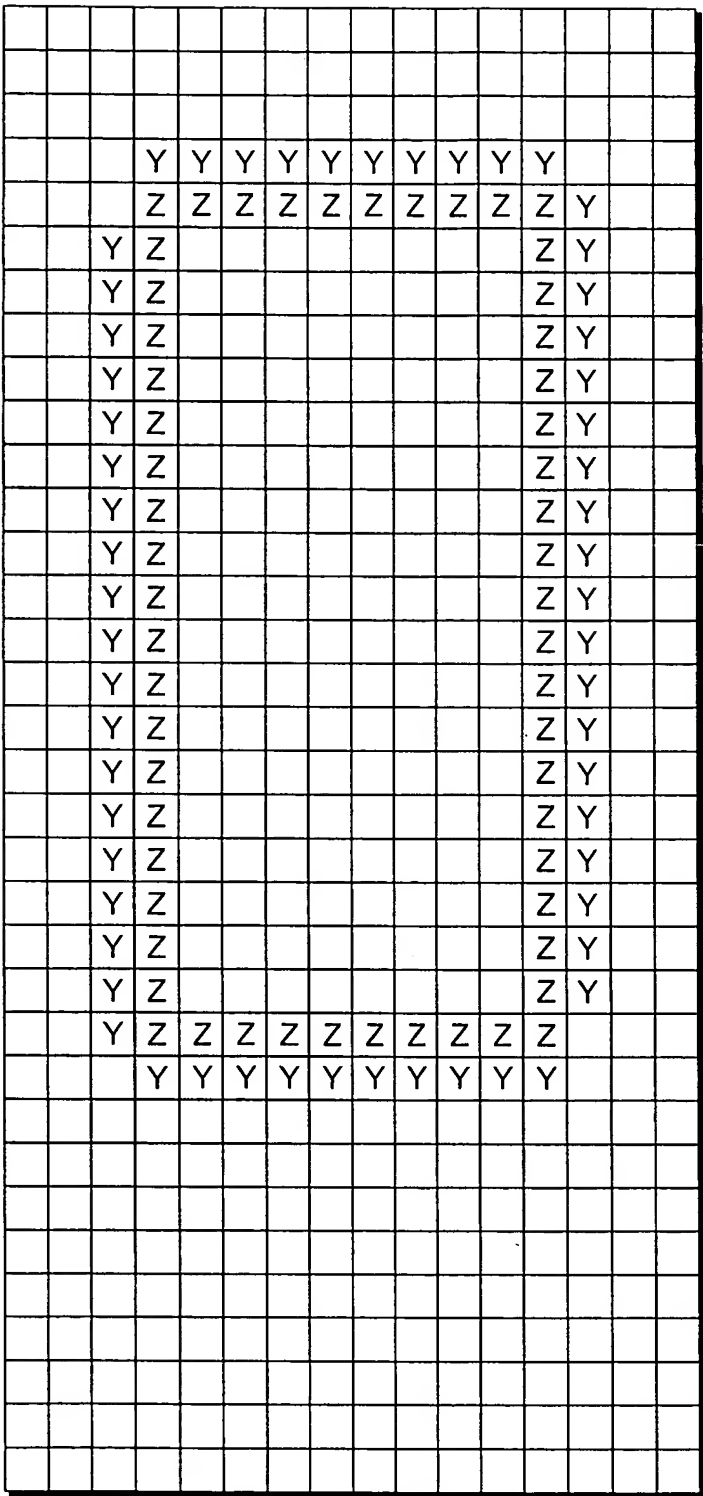


FIG. 10

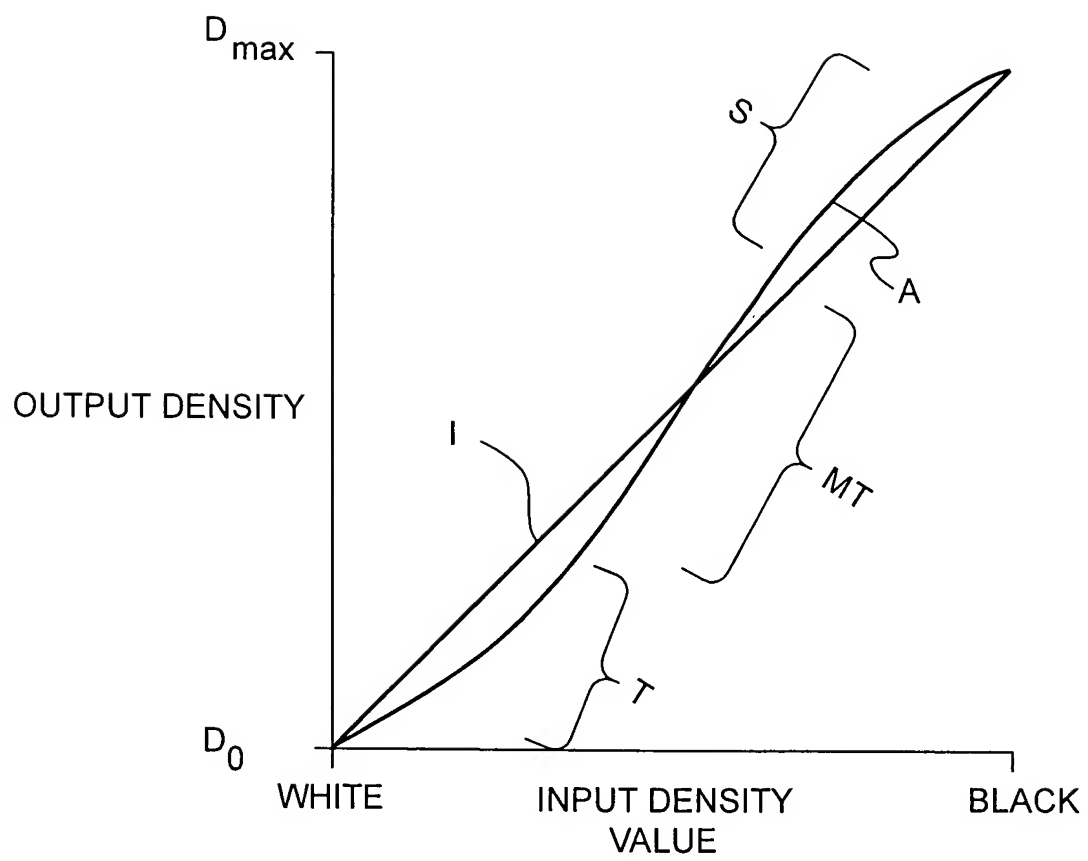


FIG. 11



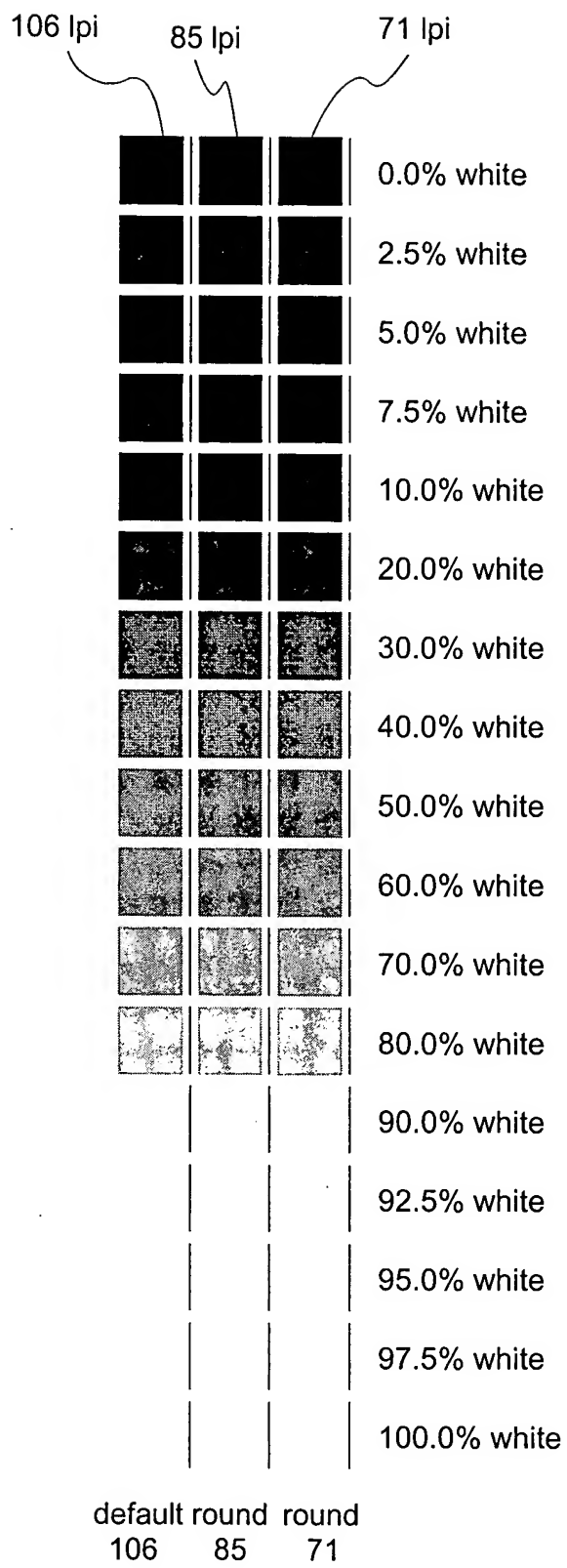


FIG. 12

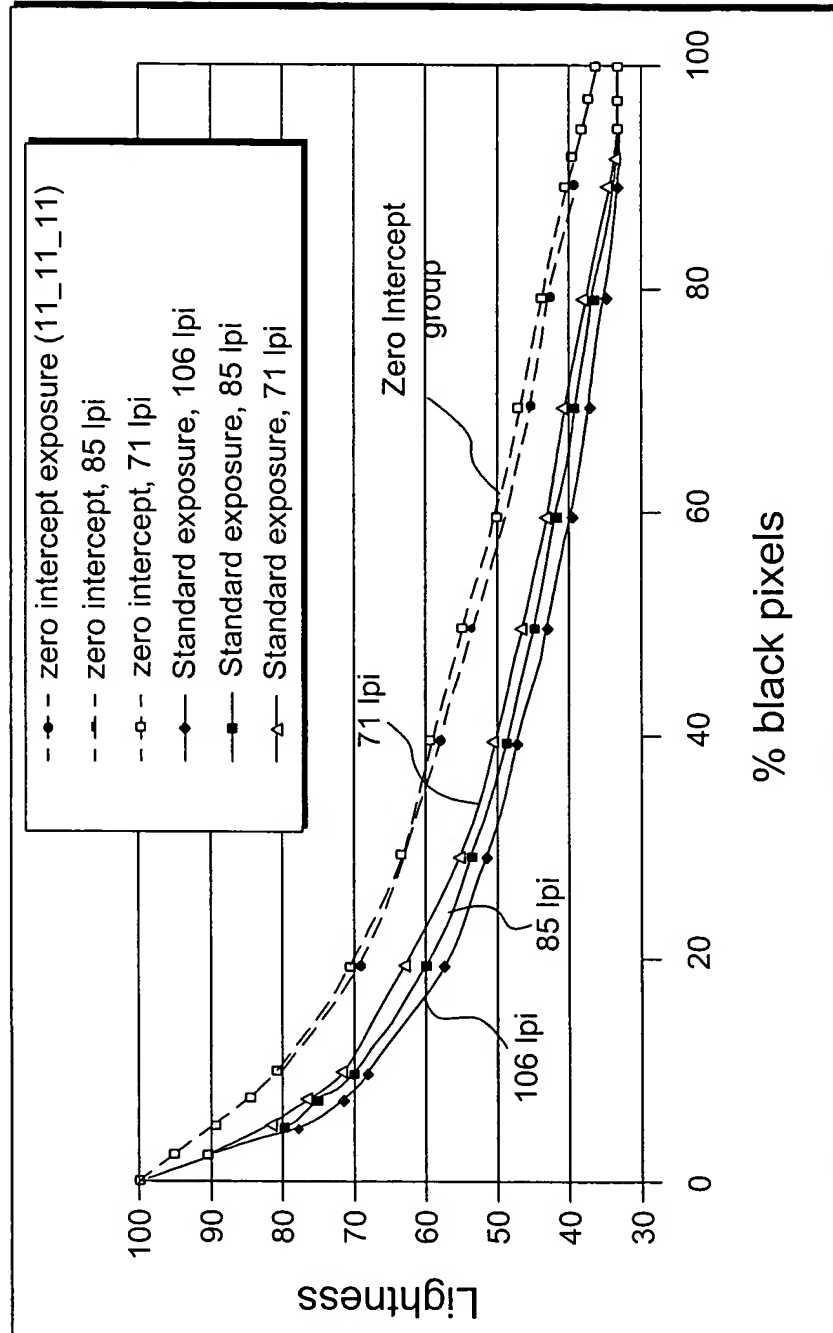


FIG. 13

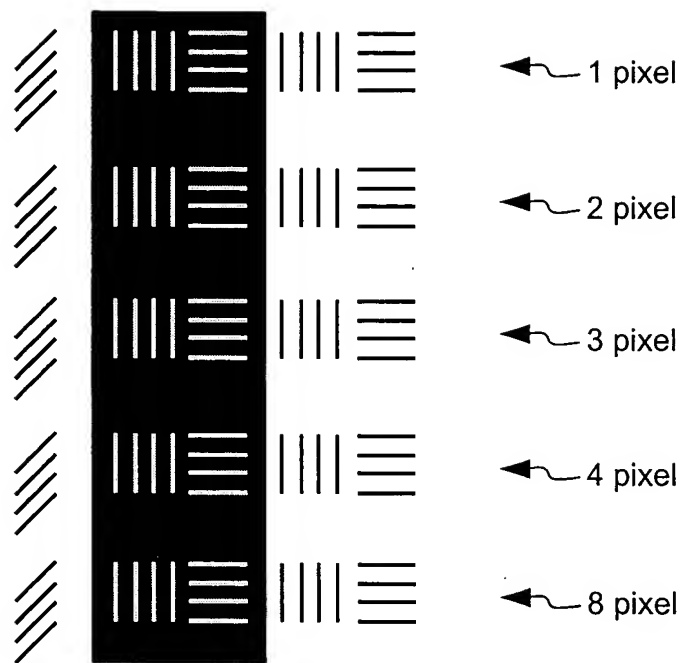


FIG. 14

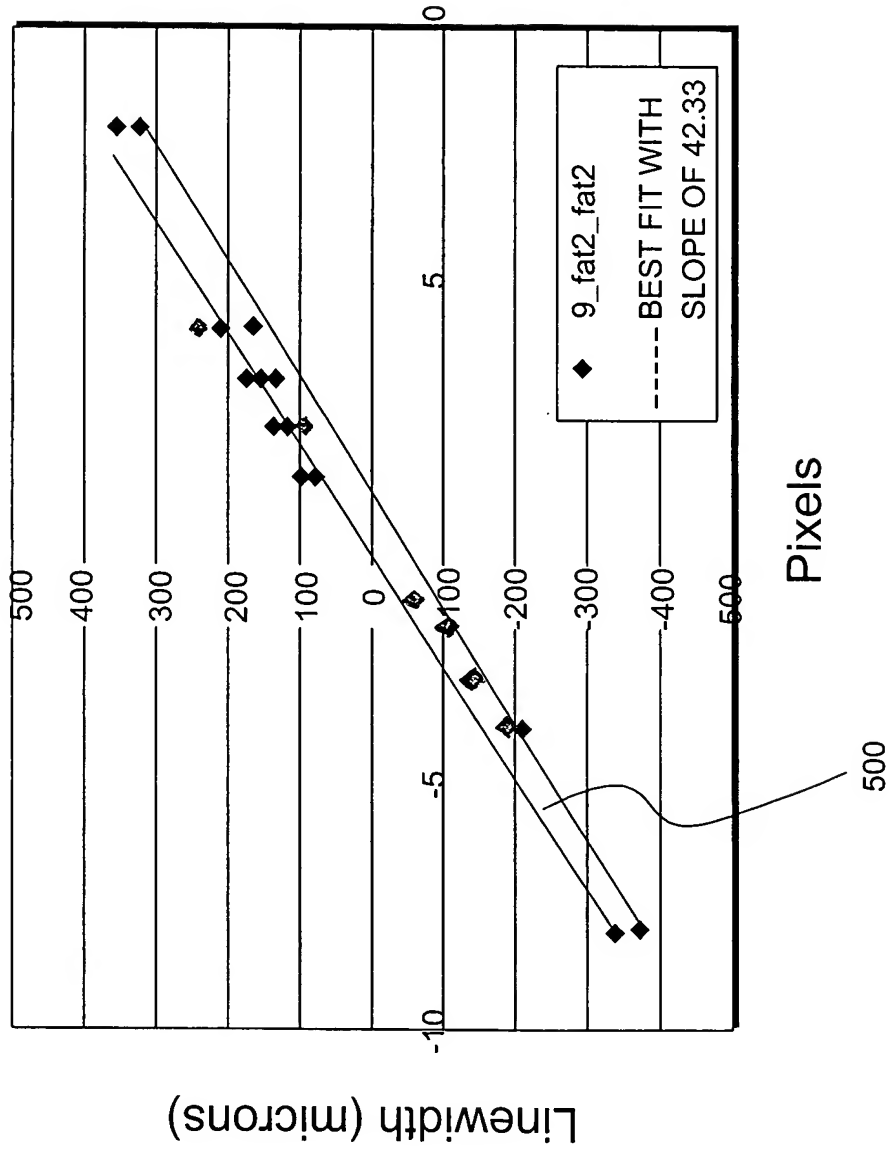


FIG. 15

20/21

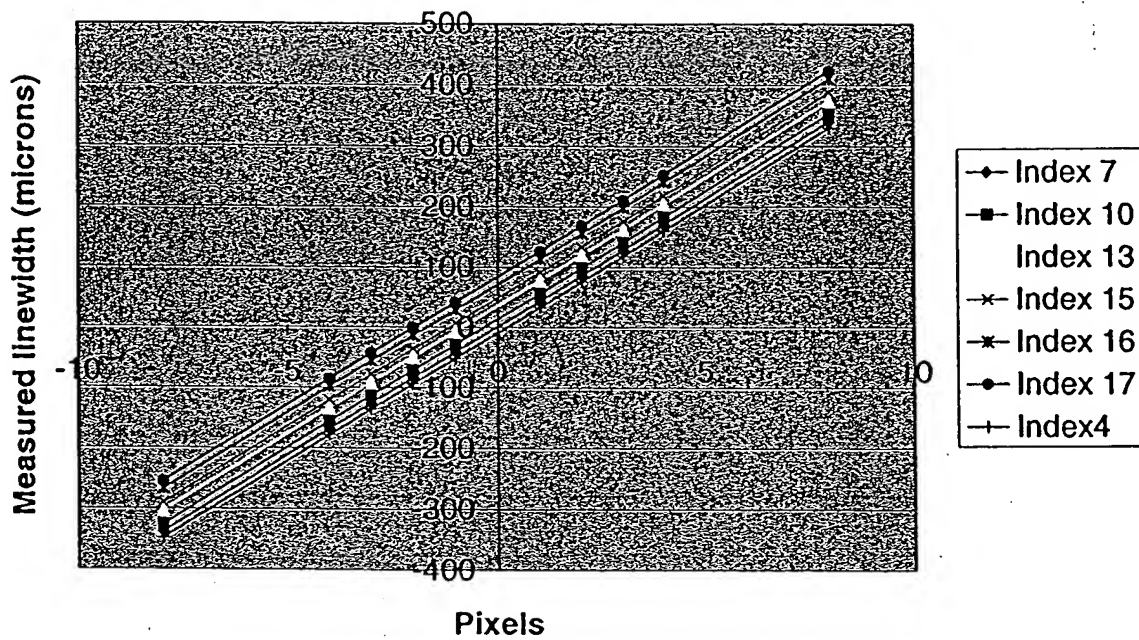


Fig. 16

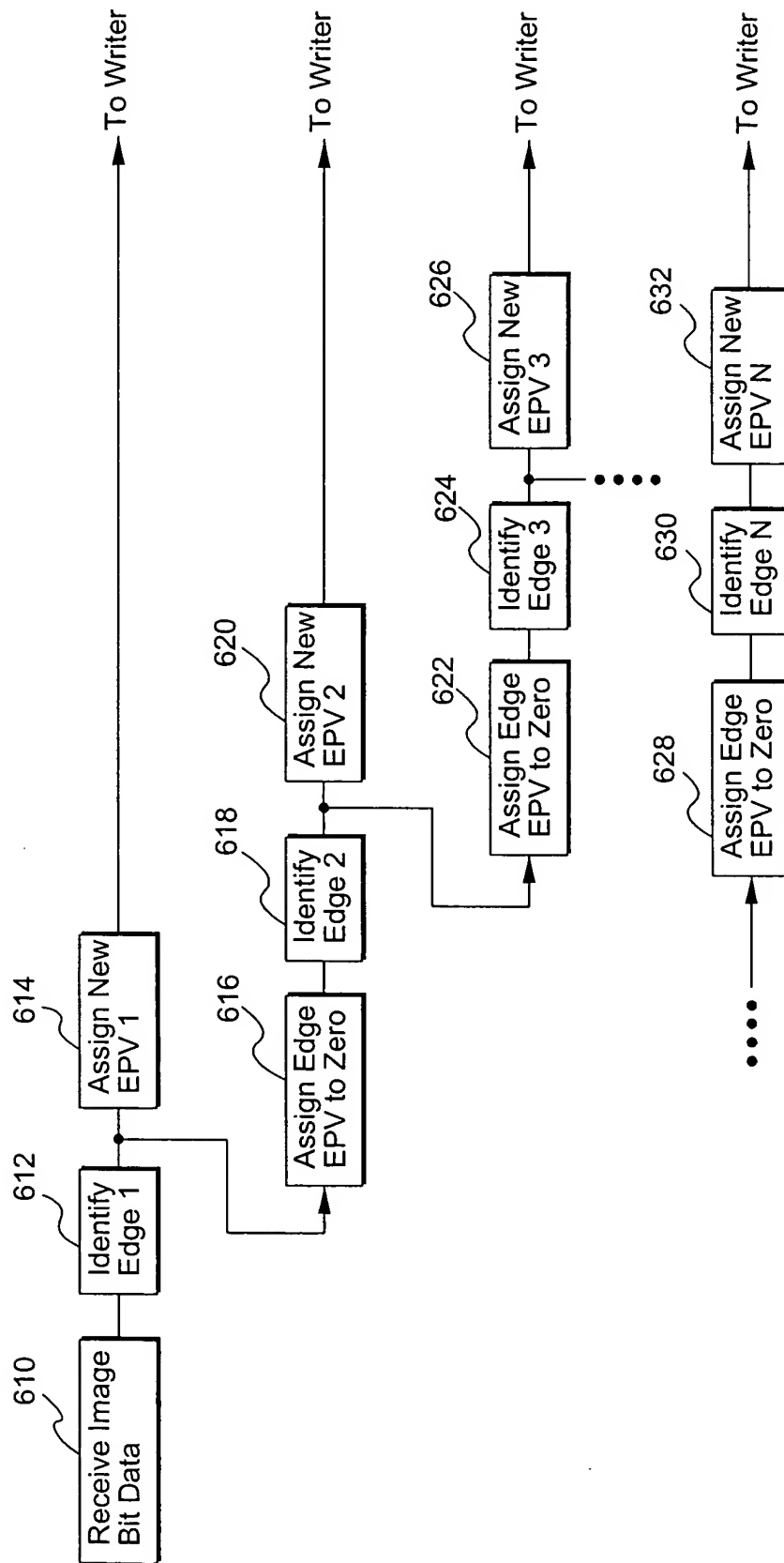


FIG. 17